Condensed Matter Physics

# OPTICAL CHARACTERIZATION OF IRON OXIDE BASED THIN FILMS PREPARED BY METALORGANIC DECOMPOSITION

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While the photoelectrolysis of water by semiconductors has seen several advances over the past 30 years, the greatest need is still the ability to produce a stable and low cost semiconductor with a low band gap that is able to absorb a large amount of the solar spectrum.[1] Iron oxide is one such low-cost semiconductor with the potential to be stable and absorb visible light. We have used a metalorganic decomposition method to prepare iron oxide and cobalt-doped iron oxide films. Iron(III) ethyl hexanoate diluted by 10% volume xylene solution was dispensed onto glass substrate, which was then spun at 4000 rpm for 15 seconds and heated in air at $400^0$C for 90 seconds. This process was repeated several times in order to obtain the desired thickness, e.g., 5 coats yielded an average film thickness of 300 nm. By adding cobalt neodecanoate (20% by volume) to the precursor solutions, cobalt-doped films were made. All the films were subjected to a final annealing at 550ºC for one hour in air. The X-ray diffraction spectra of iron oxide films (without Co doping) show no discernible peaks, whereas Co-doping induces a crystalline structure. Optical transmission measurements performed on these films at wavelengths of 175 to 3300 nm using a Perkin-Elmer Lambda 900 dual beam UV/VIS spectrometer indicate that the Co-doping reduces the bandgap value of iron oxide from 2.1 eV to ~1.6 eV. Further details and analysis of the optical transmission spectra will be presented.

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[1] S.U.M. Khan and J. Akikus, J. Phys. Chem. B, **103**, 7184, 1999.

L. D. Borum is supported by NSF-REU grant No. EEC-0097736.